1908. Dr. and Mrs. Vernon have succeeded in presenting an admirable account of the progress of science in Oxford from the days when Willis, Bathurst, Seth Ward, and Robert Boyle held their meetings at the lodging of Wilkins, Warden of Wadham, in which college Sydenham and Wren were at that time undergraduates. The history of the struggles and ultimate success of the little band who, led by Acland, Daubeny, and Walker, with help from Pusey, resolved that, so far as in them lay, science should take its proper place among the activities of Oxford, is carefully and sympathetically recorded. The work of the museum during the fifty years of its existence—work associated with the names of Phillips, Brodie, Prestwich, Rolleston, Moseley, Lankester, and Burdon-Sanderson, to mention only a few—forms the subject of a specially interesting chapter; and the book ends with an account of the jubilee commemoration itself. We wish that the authors had found space to include in their record the address delivered on that occasion by Dr. Vernon Harcourt—an address justly characterised by them as "most instructive and entertaining." Extracts, however, are incorporated in the body of the work.

The book is attractively got up, and illustrated with some good photographic plates, in the legends of two of which, unfortunately, the points of the compass are incorrectly given. We reproduce views of the exterior and part of the interior of the original building. F. A. D.

THE DISTRIBUTION OF FRESH-WATER EELS.[1]

IT is certain that the hydrographers of the *Challenger* and other deep-sea expeditions made their physical observations in the Atlantic Ocean depths all unsuspecting of the fact that thereby they were essentially helping to make an important contribution to the natural history of the fresh-water eel. Yet this fact constitutes part of the interesting information derived from a perusal of Dr. Schmidt's latest publication, a continuation of his previous famous researches upon the eel which have previously been described in the pages of NATURE.

In spite of the abundance and wide distribution of the genus Anguilla, the first and final chapters of its life-history were, until quite recently, matters of profound obscurity. It is a fact of common observation and knowledge that the elvers or glass-eels which in the spring months ascend our rivers frequently in countless numbers develop into young eels, and also that adult eels in their silvery breeding dress descend to salt water in autumn; but there, until a few years ago, knowledge ended and conjecture began. It was a common belief in this country that estuaries and harbours probably afforded the spawning places. In 1893 the Italian zoologists Grassi and Calandruccio proved that *Leptocephalus brevirostris,* a deep-water fish of obscure systematic position taken in the Mediterranean, was really a larval stage of the common eel. Dr. Schmidt and his Danish colleagues, whose energies were first directed upon this particular research because of the economic importance of the eel-fishery in their country, traced the early "elver" stage down to the open sea, and at last, by their deep-water investigations in 1904–5, succeeded in locating an important breeding region off the west coasts of the British Isles at depths of more than 1000 metres. Subsequent trawlings have revealed the distribution of the early (Leptocephalus) larval stage in the Atlantic Ocean from the Færoë Islands to Gibraltar, but always in water of more than 1000 metres depth and not less than 7° temperature. From these investigations, Dr. Schmidt came to the conclusion that "in order to propagate, this species demands certain external conditions (chiefly great depths with high temperature and salinity of water)," and it was to test the validity of this conclusion for other parts of the world that the research upon the geographical distribution of the fresh-water eel was commenced.

The Anguilla genus is widely distributed, being found in the Atlantic as well as in the Indian and Pacific regions. However, the main point of this inquiry will be best indicated by limiting our consideration to the regions of America, Europe and Africa where most data are available, and where (if we except eastern Africa) the question is simplified by being confined to two species only, viz. *Anguilla vulgaris,* the European species, and *A. chrysypa,* the American form. Now fresh-water eels are entirely lacking on the Pacific shores of North and South America (and of course in the river systems which have their outlet on this coast). On the Atlantic side, however, they are abundantly represented in the easternmost parts of Canada and the United States, and are found from southernmost Greenland and Labrador to the West Indian Archipelago and Guiana. On the other hand, they are lacking in South America south of Guiana, no single record, for example, occurring of the presence of fresh-water eels in the large river systems of Brazil and Argentina. They are found on practically all the islands of the Atlantic north of the Equator (Bermudas, Azores, Madeira, Canaries, Iceland, &c.), and, what is especially worthy of attention, they occur on islands where other fresh-water fishes are completely lacking. On the eastern side of the Atlantic they are found from the region of North Cape and southwards along all the coast of Europe, on all coasts of the Mediterranean, and on the north-western part of the coast of Africa. In Senegal they disappear, and are absent from all the rest of the west coast of Africa as far as Cape Colony, where the Indian Ocean species begin to be met with.

Thus in tropical, temperate, and even Arctic regions, Atlantic fresh-water eels are found—truly a wide-spread habitat, and one affording extremely varied environments! But it is on account of "this astonishing power to submit to most varied outer conditions" that their absence from certain regions is apparently incomprehensible. Why, for example, have they not been able to penetrate further southwards along the coasts of the Atlantic? In order to understand this, it is necessary to recall some of the results of later years' marine biological investigations, especially "the ascertained fact that very often the sensitiveness of a species of fish to its surroundings differs a great deal in its growth-period and in its spawning-time, so that during the latter its requirements as regards the outer conditions (depth, temperature, salinity) are much more definite and very different from those during the first, the effect of which is that the distribution during spawning-time may often be very different from that during growth. . . . It is in the first instance the requirements as regards the outer conditions during spawning time which influence the distribution."

The earlier investigations upon the spawning places of the eel have shown that in order to be able to propagate, the European fresh-water eel requires great depth (at least 1000 metres), a high salinity (more than 35·2 per cent.) and temperature (more than 7° C.) at this depth; and this is where the importance of the hydrographical data obtained from the temperature curves of the *Challenger, Valdivia,* and other deep-sea expeditions comes in. It is shown that "the absence of eels in

[1] On the Distribution of the Fresh-water Eels (Anguilla) throughout the World. (1) Atlantic Ocean and Adjacent Regions. A Biogeographical Investigation. By Johs Schmidt. With one chart. Pp. 45. (Copenhagen, 1909.)

all the large fresh-water systems of South America, western North America, and West Africa is due to the fact that the temperature in the deeper layers of the adjacent seas is too low to admit of the propagation." Incidentally, an explanation is afforded of the hitherto puzzling lack of success which attended the transplantation of eels from the eastern to the Pacific States by the U.S.A. Fish Commission in 1874 and other years. The eels themselves flourished in their new surroundings, but the Pacific Ocean afforded no place for successful reproduction.

Oceanic hydrography has thus supplied the indispensable key to the elucidation of a point in the biology of a species which is universally regarded as a fresh-water form. More strictly, however, *Anguilla vulgaris* may be considered as an oceanic species which has acquired the habit of migrating to fresh water for food and protection.

After all, the most interesting feature of this work is that it deals with an extreme case of the problem of the relationship between physical environment and fish propagation, a most important question in connection with the economic aspect of the fish supply. Dr. Schmidt has contributed pioneer work of great value towards the understanding of these phenomena in regard to other species besides the eel. We may mention, for example, his research upon the plaice and cod in Icelandic waters, where he has shown by marking experiments that a regular spawning migration takes place into the warmer Atlantic water off the south and south-west of the island. Here again the phenomena are clear and comprehensible, because they are, as it were, "writ large"—the difference in temperature between the cold water off the north and east and the warmer Atlantic waters off the south and west of the island being very marked, which renders the migration practically an absolute necessity for the survival of the offspring. Essentially the same in principle are the problems of correlated physics and biology in British seas which still, to a great extent, await elucidation. But here the phenomena are not "writ large"; on the other hand, they can only be demonstrated by the study of observations made with fine precision and extended over a considerable period of time. A. E. H.

THE PARIS FLOODS.

IT is now an evident fact that Paris has recently suffered the ravages of an inundation greater and more severe than any which have visited the city within the last two and a half centuries. A gauge at the bridge of La Tournelle shows the surface of the water as having reached a height above the bed of the river of 27 feet 10½ inches. Normally, it is only about 8 or 9 feet, and it is necessary to go back so far as the year 1658 in order to find any record exceeding, or even approaching, this figure. At that date the height attained was 28 feet 10½ inches. A few years previously (1651) there was a flood of 25 feet 8 inches, and in 1649 another of 25 feet 2 inches. The flood of 1802, great as it was, did not exceed 24 feet 5 inches, and that of 1876 only reached 21 feet 11 inches.

The known records are as follows:—

		ft.	in.
February	1649	25	1½
January	1651	25	8
February	1658	28	10½
February	1690	24	9
March	1711	25	0
December	1740	25	11
February	1764	24	0½
January	1802	24	5
March	1807	22	0
January	1910	27	10½

The causes of the flood are not quite so obvious as the effects. At first sight it would appear that there is no very satisfactory explanation to be vouchsafed. In the watershed of the Seine and its tributaries there is an absence of lofty ranges with snow-capped summits, capable of producing copious liquidations such as prevail in mountainous regions. But on the other hand, there are numerous impermeable districts within the Seine Basin where the rainfall finds its way almost entirely into the river bed, and if to the effect of a prolonged precipitation in these areas there be added the far from negligible contribution of melted snow from the impermeable Morvan Plateaux, produced under the influence of a sudden and abnormal rise in temperature, we need not pursue inquiries very much further in order to arrive at an adequate solution of the problem.

The Seine at Paris is formed by the confluence of three important streams: the Yonne, the Upper Seine, and the Marne. Of these the Yonne is the only one presenting torrential characteristics; it rises rapidly, and subsides as quickly. The other two streams move more slowly, and change less abruptly. After a period of heavy rainfall the flood waters of the Yonne arrive first at the point of confluence, reaching it at the end of three or four days, and they produce the greater portion of the rise in level. Four or five days later the waters of the Upper Seine and Marne arrive, having been fed by filtrations through more permeable ground and by surfeited springs, and these simply serve to maintain the effect of the previous increment. If towards the end of this period the previous meteorological phenomena in the upper reaches repeat themselves, the effect produced is that of a single continuous flood of considerable intensity.

Fortunately, floods in the neighbourhood of Paris can be predicted sufficiently in advance to enable remedial, or at any rate palliative, measures to be undertaken. The Seine, as has been pointed out, rises but slowly, and the effects of floods in its affluents are visible several days beforehand, and can be announced accordingly. There is ample warning for the inhabitants to withdraw, if need be, from the threatened quarters. An empirical rule has even been established which enables the height attainable by the flood to be approximately stated. The rise of the Seine at Paris is just about double the mean of the partial rises in its affluents at certain fixed points. The hygrometric service of Paris, therefore, plays a very useful part in issuing these forecasts, and renders valuable service to the community at large.

PROF. F. PURSER.

THE news of the death of Prof. F. Purser, professor of natural philosophy in the University of Dublin, announced in last week's NATURE, has been received with deep regret. His life had just reached the regular period of seventy years, and intellectually he was as vigorous as ever.

Prof. Purser was one of the ablest and most brilliant members of a very clever family. His father managed Guinness's Brewery in the time of Sir Benjamin Guinness, and it was to a great extent owing to his skill, foresight, and enterprise that the brewery attained the colossal dimensions it possesses at present. His elder brother was a mathematician of a very high class, and was for several years professor in Queen's College, Belfast.

Two of his cousins were distinguished professors of the University of Dublin. One held the chair of institutes of medicine, or physiology; the other, Dr. Louis Purser, was professor of Latin, and is still public orator.